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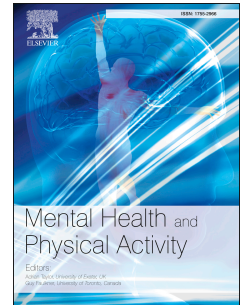
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# Accepted Manuscript

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**Self-determination and stage of readiness to change physical activity behaviour in  
schizophrenia**

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**Abstract**

*Purpose:* The present study examined whether reasons for physical activity, as formulated by the self-determination theory, differed across the stages identified by the transtheoretical model of behaviour change.

*Methods:* A total of 129 persons with schizophrenia completed the Behavioural Regulation in Exercise Questionnaire-2 and the Patient-centred Assessment and Counselling for Exercise questionnaire. Multivariate and discriminant analyses were applied to determine whether reasons for physical activity differed between men and women and across the stages of change.

*Results:* Discriminant analyses indicated that persons with schizophrenia at the early stages of change are less autonomous in the regulation of their physical activity behaviour than those at the later stages. Multivariate analyses showed a difference in amotivation, external regulation, and autonomous regulation, but not introjected regulation across the different stages of change.

*Conclusions:* Our results suggest that autonomous motivation may have an important role to play in the adoption and maintenance of health promoting behaviours in persons with schizophrenia.

Research is needed to develop our understanding of physical activity behaviours in persons with schizophrenia (Beebe et al., 2012; Vancampfort et al., 2012a) since it has been found to yield a plethora of benefits (Gorczyński & Faulkner, 2010; Scheewe et al., 2013; Vancampfort et al., 2009, 2012b). Despite this, there is a relatively high prevalence of physical inactivity (Faulkner et al., 2006; Lindamer, 2008; Vancampfort et al., 2013a). As a result, clinicians face the challenge of promoting physical activity behaviours in this population group.

One of the most commonly adopted models of behaviour change is the transtheoretical model (TTM) (Prochaska & Di Clemente, 1983; Prochaska & Marcus, 1994). The model has been successfully utilised to describe the different phases that individuals with schizophrenia pass through in the acquisition and maintenance of health behaviours (Archie et al., 2007; Gorczyński et al., 2010). The TTM provides a framework for categorising a person's readiness to change their behaviour and includes five stages. In the first stage, the pre-contemplation phase, individuals are physically inactive and are not thinking about becoming more active within the next six months. During the next stage, the contemplation stage, individuals think about becoming more active within the next six months. In the third stage, the preparation stage, individuals are engaging in some physical activity, while in the penultimate action stage individuals have been regularly active for less than six months. Lastly, the maintenance stage is characterised by an individual having sustained regular physical activity for more than six months. TTM also comprises a secondary dimension, the processes of change, which are perceived as techniques and strategies differentially employed by patients across the stages of change. Ten processes of change have received the most empirical support, separated into five cognitive processes of change (e.g., consciousness raising) and five behavioural processes (e.g., stimulus control) (Prochaska et al., 1992).

Although the TTM has been recognised as an important model for behaviour change in individuals with schizophrenia (Esterberg & Compton, 2005; Archie et al., 2007; Gorczyński et al., 2010), the model has limitations. For instance, it fails to explain why individuals engage in physical activity or remain inactive, nor does it identify the mechanisms that underlie physical activity adoption and/or maintenance. However, it is essential to gain insight in the reasons why some people are physically active while others in the same environment are not. Thus, it is important that research examines individuals' reasons for being physically active.

The self-determination theory (SDT) (Deci & Ryan, 1985, 2000; Vansteenkiste, et al., 2010) is a motivational theory that provides an insight into reasons why persons adopt and maintain certain health behaviours. The theory proposes motivation is multidimensional and resides along a continuum of increasing self-determination. The lowest end of the continuum is identified as amotivation which represents a general lack of motivation to change behaviour due to discouragement. Following along the continuum, external regulation refers to exercising to avoid punishment or criticism or to obtain promised rewards or external appreciation. Introjected regulation refers to the imposition of pressures onto one's own functioning, for instance, by buttressing one's activity engagement with feelings of guilt, self-criticism, or contingent self-worth. More volitional or autonomous forms of functioning include identified regulation, which involves foreseeing the personal importance of the activity, and integrated regulation, which implies that physical activity is brought in harmony with other prevailing life values, such that being active becomes prioritised within one's lifestyle. Finally, intrinsic motivation involves engaging in physical activity for its own sake, that is, because one finds being active stimulating or enjoyable by itself.

In distinguishing SDT from TTM, the latter assumes, at least implicitly, a more quantitative perspective on motivation. That is, it can be derived from the TTM-framework

that individuals who are at higher stages of change are more strongly motivated than those at lower stages of change. In contrast, SDT also highlights the importance of exercisers' type or quality of motivation, as it is maintained that engagement in physical activity can be regulated by autonomous or volitional, relative to more controlled or pressured reasons. The assumption is that when autonomous exercise regulations are supported, not only the initiation but also the regular (i.e. frequent) participation in physical activity will be better secured. That is, as far as the reasons for exercising get fully integrated within individuals' personal values and interests and, hence, become part of their living style, individuals are more likely to willingly exercise over longer periods of time. Consistent with this assumption, recently significant positive correlations were found between the level of physical activity participation during the previous week and amotivation ( $r=-0.44$ ,  $P<0.001$ ), external regulation ( $r=-0.27$ ,  $P<0.001$ ), and identified and intrinsic regulations ( $r=0.57$ ,  $P<0.001$ ) in a sample of patients with schizophrenia (Vancampfort et al., 2013b).

There are however three reasons why research is needed to investigate also intentions and maintained engagement in physical activity behaviour over a longer period of time (6-months). First, in light of the complex and dynamic nature of physical activity behaviour, it seems unfeasible that a 7-day recall of physical activity is able to truly capture a patient's behavioural patterns over a longer term. For example, due to the nature of their illness, patients with schizophrenia often experience lapses in trying to adhere to physical activity programmes (Vancampfort et al., 2012d). Such drop-out from physical activity programmes could be partly attributed to the motivation underlying physical activity behaviour (Sorensen, 2006). Second, the consideration of long-term engagement in physical activity is also interesting from a theoretical perspective. That is, although previous studies have found some forms of controlled (i.e., introjected) regulation to be positively associated with concurrent levels of physical activity (Teixeira et al., 2012), these associations have been found to wane



when the assessment period is extended, presumably because the pressured regulation is more readily undermining energy required for sustained engagement (Pelletier et al., 2001; Teixeira et al., 2012; Vansteenkiste et al., 2004). Although a longitudinal design would be ideal to answer this question, the maintained engagement in physical activity can be indirectly captured through the assessment of the stages of change. Third, apart from studying individuals' initiation and maintenance of physical activity behaviour, it is also interesting to find out whether some patients start to formulate intentions to engage in physical activity or do not consider doing so at all. The initial stages of change (pre-contemplation and contemplation) of the TTM precisely captures such emerging readiness to change in the future. For these reasons, it is useful to examine how SDT-based reasons for physical activity relate to stages of change in TTM, an issue that a few previous studies in the general population (Mullan & Markland, 1997; Rose et al., 2005) and among specific populations including African American women (Landry et al., 2004), and college students (Farmanbar et al., 2009) have shed preliminary light on.

The aim of this study was to evaluate in persons with schizophrenia the associations between the TTM stages of change and the reasons for being physically active as discerned within SDT. It was hypothesised that more autonomous forms of motivation (i.e. identified and intrinsic regulations) would be prevalent in more advanced stages of change (i.e. preparation, action and maintenance). In contrast, more controlling forms of motivation (i.e. external and introjected regulations) and in particular amotivation would be enhanced in the least advanced stages of change (i.e. pre-contemplation and contemplation).

## 1. Methods

### 1.1. Participants and procedure

A cross-sectional multi-centre design was used incorporating 13 centres that treat persons with schizophrenia (see acknowledgements). The centres were located across the five Dutch-speaking provinces of Belgium. All patients who had a DSM-IV diagnosis of schizophrenia (American Psychiatric Association, 2000) were invited to participate. The diagnosis was established by experienced psychiatrists responsible for the treatment. Individuals were included if they were: (1) inpatients or outpatients with schizophrenia, (2) had a full or partial remittance in symptoms, and (3) were able to concentrate for 20 to 25 minutes. Individuals were excluded if they were located within an intensive supervision unit. Also persons who experienced acute paranoid delusions were excluded. No incentive was provided for participation. The study procedure was approved by the 13 ethical committees based at each centre. All participants gave their written informed consent. More detailed information regarding to the demographical data of the included participants is presented elsewhere (Vancampfort et al., 2013b).

### 1.2. Behavioural Regulation in Exercise Questionnaire

The Behavioural Regulation in Exercise Questionnaire-2 (BREQ-2) (Markland & Tobin, 2004) is used as an interviewer-administered questionnaire. The questionnaire comprises of 19 items relating to reasons to be physically active derived from the self-determination theory. Each item is measured on a five-point Likert-scale, from 0 ('Not true for me') to 4 ('Very true for me'). In accordance with previous research (Vancampfort et al., 2013b) "identified regulation" and "intrinsic regulation" were combined to a single factor labelled "autonomous regulation".

### *1.3. Stage of readiness to change*

Stages of change were assessed using a modified version of the stage of change questionnaire from the Patient-centered Assessment and Counseling for Exercise (PACE) questionnaire (Long et al., 1996). For this study, physical activity was defined as moderate intensity activity for 30 minutes on most days of the week (e.g., activities that take moderate physical effort and make you breathe somewhat harder than normal). Participants chose one of five options: “I’m not physically active and I don’t intend to start” (pre-contemplation); “I’m not physically active but I’m thinking about starting” (contemplation); “I’m active occasionally” (preparation); “I’m active regularly and started in the last 6 months” (action); and “I’m active regularly and have been for longer than 6 months” (maintenance). The PACE has been successfully used in individuals with schizophrenia (Archie et al., 2007; Gorczynski et al., 2010). For the purposes of this research the questionnaire was interviewer administered.

### *1.4. Statistical analyses*

A multivariate analysis of variance (MANOVA) was used to test for significant differences in BREQ-2 subscale scores across the TTM stages of change and between men and women. Where significant main effects were demonstrated, we followed up with comparisons of differences across groups using one-way analyses of variance (ANOVA) with post hoc tests (Scheffe) (stages of change) or T-tests (gender). Significance level was set at  $p < 0.05$ .

Next to this, a discriminant function analysis was used to determine whether the stages of change could be discriminated on the basis of BREQ-2 subscale scores. In the discriminant analysis, Box’s M was significant [Box’s M = 115.1, approximate  $F(30; 33483) = 3.6$ ,  $p < 0.001$ ]. This indicates the null hypothesis of equality of covariance matrices across groups has to be rejected. However, Box’s M is a conservative test. Discriminant analysis procedures

are fairly robust against departures from the assumptions of multivariate normality within groups and equality of covariance matrices across groups (Duarte Silva & Stam, 1995). Variables with structure coefficients greater than 0.30 were used to define the meaning of the functions (Pedhazur, 1982). Stage of change group differences were evaluated by examining the values of the discriminant functions at the group centroids. Positive values indicate that a group scores high on a function while negative values indicate that a group has a low score on that function. Lastly, classification functions for each stage of change group were then generated from the discriminant functions. The classification functions permit the input of an individual's raw score for each of the BREQ-2 variables to estimate the probability of the membership in each of the stage of change groups. The individual was predicted to belong to the group for which the highest probability estimate was obtained.

SPSS 20.0 was used for data analysis (SPSS Inc, Chicago, IL).

## 2. Results

### 2.1. Participants

A total of 168 Belgian individuals (all Caucasian) with a DSM-IV diagnosis of schizophrenia (American Psychiatric Association, 2000) were initially recruited. Thirty-two persons declined participation and missing data was identified in seven cases. A total of 129 persons (44♀) with schizophrenia with a mean ( $\pm$ SD) age of  $40.6 \pm 12.7$  years and a mean ( $\pm$ SD) body mass index (BMI) of  $27.4 \pm 4.7$  were included in the final analysis. Sixty-eight persons (55.7%) were outpatients, 16 were in their first-episode (13.1%).

### 2.2. Stages of change

Eleven (8.5%) persons with schizophrenia reported being in pre-contemplation, 17 (13.2%) in contemplation, 25 (19.4%) in preparation, 37 (28.7%) in action, and 39 (30.2%) in maintenance. Due to the relatively small numbers in the first two stages, we followed Mullan and Markland (1997) who combined the two stages of change to form a single stage that was labelled “pre-preparation” ( $n=28$ ; 21.7%). Means and standard deviations at each stage of change for each BREQ-2 subscale are presented in Table 1.

[Add Table 1 about here]

### 2.3. Analyses of variance

MANOVA was performed with the BREQ-2 scores as dependent variables and gender and stage of change as independent variables. Overall, the analysis demonstrated only main effects for stages of change (Wilks' Lambda = 0.44,  $F(12,312)=9.6$ ,  $p<0.001$ ), and not for gender (Wilks' Lambda = 0.98,  $F(4,118)=0.70$ ,  $p=0.59$ ). Also no interaction effects for gender by stage of change were found (Wilks' Lambda = 0.91,  $F(12,350)=0.95$ ,  $p=0.50$ ). Follow-up ANOVA with post hoc Sheffe demonstrated that amotivation, external regulation and

identified and intrinsic regulations, but not introjected regulation differed across the different stages of change. All (sub-) analyses investigating differences in motivation regulations across stages of change are presented in Table 1. Based on the multivariate analyses, the current discriminant analysis was not conducted for men and women separately.

#### 2.4. Discriminant analysis

Table 2 summarises the findings of the discriminant analysis for the entire group. One function (canonical  $r=0.76$ ; Wilks'  $\lambda=0.38$ ,  $df=12$ ,  $p<0.001$ ) explained 91% of the between-groups variability. As judged by the correlations between the discriminating variables and the discriminant function, the function was dominated by autonomous regulation ( $r=0.76$ ) and by amotivation ( $r=-0.74$ ). The values of the discriminant functions at the group centroids were examined. The structure coefficients of this function identified that amotivation made a significant negative contribution to the discriminant function, while autonomous regulation made a significant positive contribution. The centroid values indicate that the pre-preparation group can be located at the positive end of the continuum and the maintenance group at the negative end. Overall, 74 (57.4%) of the participants were accurately classified, which is an improvement over the base rate (chance) prediction of 29% (i.e., the sample size [ $n=38$ ] of the largest group divided by the total sample [ $N=129$ ] and multiplied by 100).

[Add Table 2 about here]

### 3. Discussion

#### 3.1. Main findings

Promoting physical activity is an increasing health priority in psychiatric rehabilitation programmes (Richardson et al., 2005) and investigating the motivational correlates of physical activity in those with schizophrenia is important in order to understand the mechanisms that facilitate behaviour change in the long term. The present study is the first among persons with schizophrenia to demonstrate that more autonomous forms of motivation are observed in more advanced TTM stages of physical activity participation. Individuals with schizophrenia in the preparation, action, and maintenance stages were less amotivated and more autonomously motivated toward physical activity than those in the pre-preparation stages. Individuals with schizophrenia who are either beginning or continuing to engage in regular physical activity are more autonomously motivated than those who are not. In the same way those with schizophrenia who are beginning or continuing to engage in regular physical activity report less controlled forms of motivation and, in particular, less external pressures. The observation that amotivation contributed negatively to the between-groups variability suggests that feelings of discouragement do not characterize the motivational profiles of frequently active participants who have maintained their behaviour for at least 6 months. Our results therefore suggest that the maintenance of frequent participation in physical activity over a longer period in this particular population is reflective of both the quantity (i.e., lower levels of amotivation) and quality (i.e. a shift from controlled to autonomous regulations) of motivation.

#### 3.2. Practical considerations

One of the greatest challenges facing researchers and clinicians is how to motivate patients with schizophrenia to adopt and maintain an active lifestyle over the long term.

According to the stages of change framework, the promotion of optimal motivation and change is best achieved by applying the therapeutic principles and strategies that match with the patients' particular stage (Prochaska & Di Clemente, 1983; Prochaska & Marcus, 1994). The proposed strategies and techniques in each phase are however not rooted in one single theoretical framework or approach but instead represent a broad collection of diverse techniques taken from various approaches. Whereas the cognitive processes would be used by preference in the earlier, more motivation-oriented stages of change, the behavioural processes would be applied by preference in the last, more action-oriented stages of change (Prochaska & Di Clemente, 1983; Prochaska & Marcus, 1994).

Considering the current findings, two issues need to be highlighted here. First, the facilitation of autonomous physical activity motivation seems not be limited to a single stage, but instead seems vitally important across the different stages. Indeed, it has been argued that the enhancement of autonomy represents a non-specific therapeutic factor, which is critical across clinical schools and clinical populations (Ryan et al., 2011). To facilitate autonomous motivation exercisers' psychological needs for autonomy (i.e., experiencing a sense of psychological freedom when engaging in physical activity), competence (i.e., feeling effective to attain desired outcomes) and relatedness (i.e., being socially connected) need to be nurtured across these stages, as these needs represent the nutrients of enduring engagement and growth. The way health care professionals, caregivers or others attend to these needs might depend on the patients' stage of change, with some need-supportive components (e.g., acknowledging resistance, offering choice, providing a rationale) being more critical in some stages than in others. Yet, if patients perceive their psychological needs to be met, they would be more likely to develop and maintain autonomous motivation, leading them to progress across the cycle of change. Second, the critical role of more autonomous forms of motivation may especially manifest with respect to the later stages of change. That is, both autonomously and



controlled motivated exercisers may weigh up the pros and cons of change in the earlier stages, yet, autonomous forms of motivation are especially required when translating action into maintenance. Consistent with the idea that autonomous motivation may moderate the transition between the later stages of change, Thøgersen-Ntoumani and Ntoumanis (2006) found external regulation to predict greater relapse in exercising.

### *3.3. Limitations and future research*

Caution should be exercised in generalising from the present findings given the cross-sectional nature of this research. Therefore it is not possible to ascertain whether those in the later stages of change became more autonomous in the regulation of their physical activity behaviour over time as they increased their stage of change, or whether they reached the later stages of change because they were more autonomous from the start. Longitudinal and intervention studies should therefore be designed to identify the causal pathways between the different constructs. Grounded in SDT, such intervention studies should strive to foster perceptions of choice, competence, and enjoyment for physical activity, particularly for individuals who are not active on a regular basis (those in the pre-preparation and preparation stages of change). In contrast with previous research in the general population (Mullan & Markland, 1997) the current results identified no gender differences in reasons for being physically active across the stages of change in patients with schizophrenia. Future research including larger sample sizes should explore this difference with general population data more in detail. Lastly, one should be aware that the majority of the included participants were hospitalised at the time of the study. Previous research (Vancampfort et al., 2013c) demonstrated that environmental variables are significantly associated with multiple types of physical activity participation in persons with schizophrenia.

#### 4. Conclusion

Our data demonstrates that in persons with schizophrenia a higher autonomous motivation appears to be a prerequisite for participation in regular physical activity. We encourage longitudinal research that is able to consider the underlying motivational processes involved in physical activity behaviour change in persons with schizophrenia.

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**Table 1**

Means and standard deviations and differences in the BREQ-2 subscales by stage of change

Motivational type	Pre-preparation		Preparation		Action		Maintenance		F-value	p-value
	M	SD	M	SD	M	SD	M	SD		
Amotivation	1.5 <sup>a,b,c</sup>	1.0	0.4 <sup>a</sup>	0.5	0.3 <sup>b</sup>	0.5	0.1 <sup>c</sup>	0.2	34.7	<0.001*
Men	1.5 <sup>a,b,c</sup>	1.0	0.3 <sup>a</sup>	0.5	0.3 <sup>b</sup>	0.5	0.09 <sup>c</sup>	0.2	25.3	<0.001*
Women	1.6 <sup>a,b,c</sup>	1.2	0.5 <sup>a</sup>	0.5	0.3 <sup>b</sup>	0.5	0.1 <sup>c</sup>	0.2	8.7	<0.001*
External regulation	1.3 <sup>c</sup>	1.2	1.0	1.0	0.8	0.8	0.5 <sup>c</sup>	1.0	3.7	0.013*
Men	1.3 <sup>c</sup>	1.2	0.6	0.6	0.8	0.8	0.5 <sup>c</sup>	0.9	3.6	0.017*
Women	1.2	1.1	1.5	1.1	0.8	0.9	0.7	1.3	1.4	0.26
Introjected regulation	1.0	0.8	1.1	1.0	1.0	0.9	1.0	0.9	0.05	0.98
Men	0.9	0.8	1.0	0.9	1.2	0.8	0.9	0.9	0.68	0.58
Women	1.5	0.5	1.2	1.2	0.8	0.9	1.2	1.0	0.99	0.41
Autonomous regulation	1.7 <sup>b,c</sup>	0.9	2.2 <sup>d,e</sup>	0.6	2.8 <sup>b,d,f</sup>	0.8	3.3 <sup>c,e,f</sup>	0.5	33.3	<0.001*
Men	1.7 <sup>b,c</sup>	0.8	2.1 <sup>d,e</sup>	0.6	3.0 <sup>b,d,f</sup>	0.8	3.3 <sup>c,e,f</sup>	0.5	26.3	<0.001*
Women	1.7 <sup>b,c</sup>	1.0	2.4 <sup>d,e</sup>	0.6	3.3 <sup>b,d,f</sup>	0.6	3.3 <sup>c,e,f</sup>	0.6	6.6	<0.001*

MANOVA (\*model significant at  $p < 0.05$ ) with post hoc Scheffe when indicated (significance set here at  $p < 0.05$ ), Df=degrees of freedom

(between groups; within groups), M=mean, SD=standard deviation, a=pre-preparation versus preparation, b=pre-preparation versus action, c=pre-preparation versus maintenance, d=preparation versus action, e=preparation versus maintenance, f=action versus maintenance,.



**Table 2**

Discriminant function analysis using the BREQ-2 motivational types to differentiate stages of change

<b>Discriminating variable</b>	<b>Function</b>
<i>Motivational regulations</i>	<i>Structure coefficient</i>
Amotivation	0.58
External motivation	0.24
Introjected regulation	-0.007
Autonomous regulation	-0.68
<i>Stages of change</i>	<i>Centroid value</i>
Pre-preparation	1.96
Preparation	0.31
Action	-0.44
Maintenance	-1.17

**Highlights**

- Frequently physically active persons with schizophrenia are more autonomously motivated.
- Professionals should empower patients to generate their own reasons for being active.
- Physical activity interventions should foster perceptions of choice, competence and enjoyment.